AGRICULTURAL Research

U.S. DEPARTMENT OF AGRICULTURE

MARCH 1972

AGRICULTURAL
Research

March 1972/Vol. 20, No. 9

Green Kingdom

The earth so recently freed of snow lies soggy and cold as it awaits the returning warmth of spring. Although the turn of the year is still only a promise, there are signs of its coming in the lengthening days and in the leafless but now swollen-budded branches of dooryards and roadsides. Indoors, an army of gardeners, anticipation whetted during hours of poring over seed catalogs, puts final touches on its plans. Slowly spring advances until that day when the spade goes down into the earth, and the tiny seeds are planted to be brought to life by mysterious and elemental forces. The gardener's living year begins.

Old while ever new, gardening nourishes mankind's deep psychic need for close and intimate contact with the earth. Perhaps this basic yearning best explains the seeming paradox of a burgeoning number of gardeners even as people continue to migrate from countryside to megalopolis. Many of today's transposed gardeners must grow things not in an idyllic green world, but under stringent conditions imposed by the smoke, soot, and confinement of the urban environment. Sky-borne pollution, for example, puts many kinds of plants under severe stress, sometimes killing them. And gardeners who live in rooms, apartments, and townhouses often have to make do without even a small plot of earth.

Horticultural science is helping gardeners to cope with the harsh environmental changes that stem from today's pattern of life. For example, scientists are making progress in identifying, then genetically improving plants able to withstand the dirty air and insufficient light that is often the gardener's lot in urban America. At the same time, efforts are underway to develop a system of performance ratings so that city gardeners can select with assurance plants that can "do well." Horticulturists are also helping to advance the arts and skills of the townsman whose garden is the windowsill, balcony, or doorstep.

The crowded city transforms man even as he transforms his environment. It is easy for today's dwellers of asphalt streets and concrete canyons to live with blunted awareness of our primordial natural legacy. We need an awareness of nature to reenter the urban experience so that we can gain an understanding of the laws that govern life on the small sphere that is our home. Even a modest effort—perhaps a pot of herbs on the kitchen window—can bestir a lifelong allegiance to the green kingdom. Those who walk its paths, can learn the secrets of living in peace with the earth. They will ever enjoy the roll of the seasons, and the endings that flow to beginnings, seeds and the springtime of planting them.

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COVER: Frothing and bubbling, sweet sorghum juice emerges from the crusher in one step of the new process to convert sorghum to sugar. See page 8 (871X1055–23.)

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), U.S. Department of Agriculture, Washington, D.C. 20250. Printing approved by the Bureau of the Budget, June 1967. Yearly subscription rate is $1.50 in the United States and countries of the Postal Union, $2.00 elsewhere. Single copies are 15 cents. Send subscription orders to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Use of commercial names and brands is for identification only and does not imply endorsement or approval by USDA or ARS. Information in this magazine is public property and may be reprinted without permission. Credit will be appreciated but is not required. Prints of photos are available to mass media: please order by photo number.

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Precise flow rates are critical to the encapsulating process. Here, Dr. Edmondson times the flow of safflower oil as it is pumped through a homogenizer for blending with formaldehyde and sodium caseinate. The blend is dispersed into tiny droplets which are collected in tanks, held for 30 minutes, then spray-dried (0172K19–20).

Polyunsaturated milk

THOUGH MILK is considered nature's most perfect food, ARS scientists are trying to make it better for some people by increasing its content of unsaturated fats. Such "polyunsaturated" milk could significantly reduce the amount of saturated fat in the diet.

Medical authorities have linked an increase in heart and blood vessel diseases with saturated fats. Animal products such as meat, milk, and eggs are considered the major dietary sources. Dairy and beef cattle and other livestock consume unsaturated fats in grass, forage crops, and feed grains, but micro-organisms in the rumen of the cow hydrogenate, or saturate, these fats before they enter body tissues.

Continuing research first begun in Australia, ARS dairy scientists led by Ronald D. Plowman, Beltsville, Md., and ARS chemists led by Locke F. Edmondson, Washington, D.C., found that encapsulating safflower oil, which contains a high percentage of the unsaturated fatty acid, linoleic, protects the acid from saturation by the rumen organisms. When this "protected" oil is fed to dairy cows, much of it reaches the milk in an unsaturated form.

To protect the safflower oil, the scientists coated it with casein (a protein), and then treated it with formaldehyde,

then dried it. These minute capsules were fed to dairy cattle by substituting them on a weight for weight basis as part of the cow's feed.

Two Holstein cows served as test animals. One was fed the encapsulated oil at a rate of 1,500 grams per day and the other, an uncoated oil at the same rate. The treatments were alternated at 10-day intervals for 40 days.

When cows were fed the encapsulated oil, their milk's linoleic acid content increased from 3 percent of the total fat to 30 to 35 percent. In a subsequent experiment, feeding 800 grams per day of the encapsulated oil increased the unsaturated fats to 17 percent of the total fat.

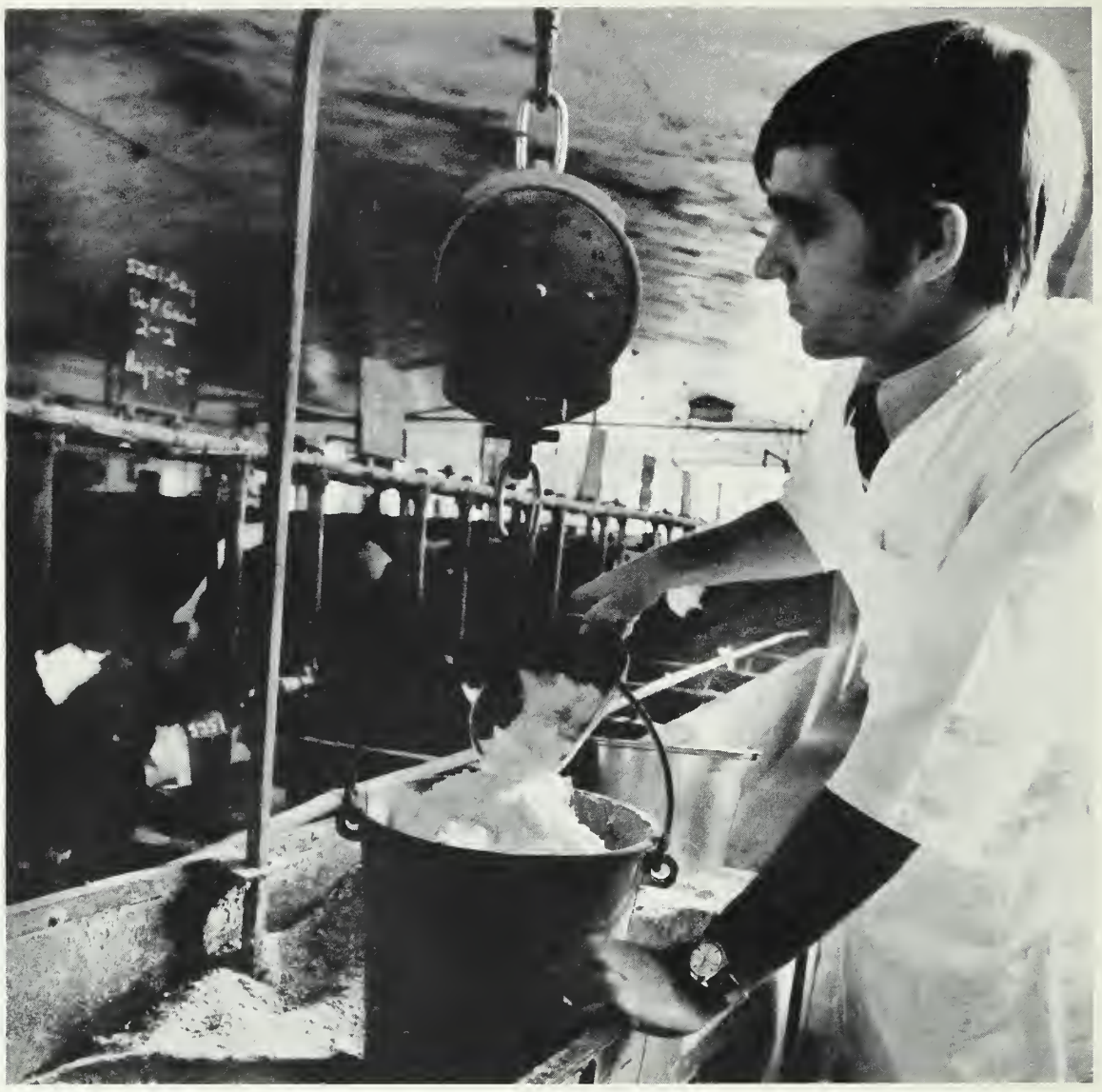
Feeding the encapsulated oil also significantly increased the fat content of the milk. This increase was noticed 24 hours after the oil feeding began and persisted for 2 to 3 days after the feeding ceased. Milk production remained about the same.

Experiments are now under way with four test and four control cows to determine the long-range physiological effects of producing unsaturated milk fat. Half of the milk from the test cows is being fed to calves to determine its effect on their growth rate. The rest is being used for cheesemaking and flavor studies.

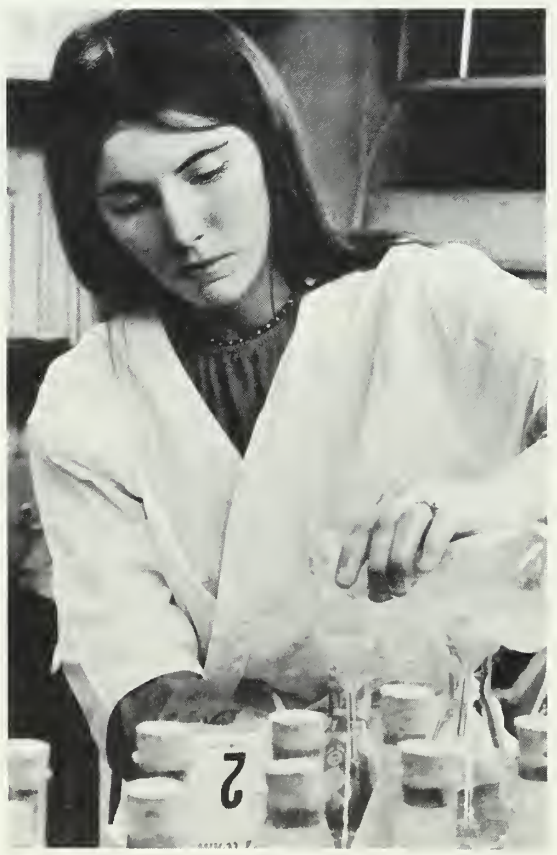
Taste panel results show that milk from cows fed the protected oil has a definitely oxidized flavor which also affects the cheese. Ways are being sought to reduce this flavor.

The scientists plan to feed cows other encapsulated oils, such as soybean. Safflower oil is relatively expensive, and other, less expensive oils may be just as effective, permitting an oil-protein combination practical for dairymen.

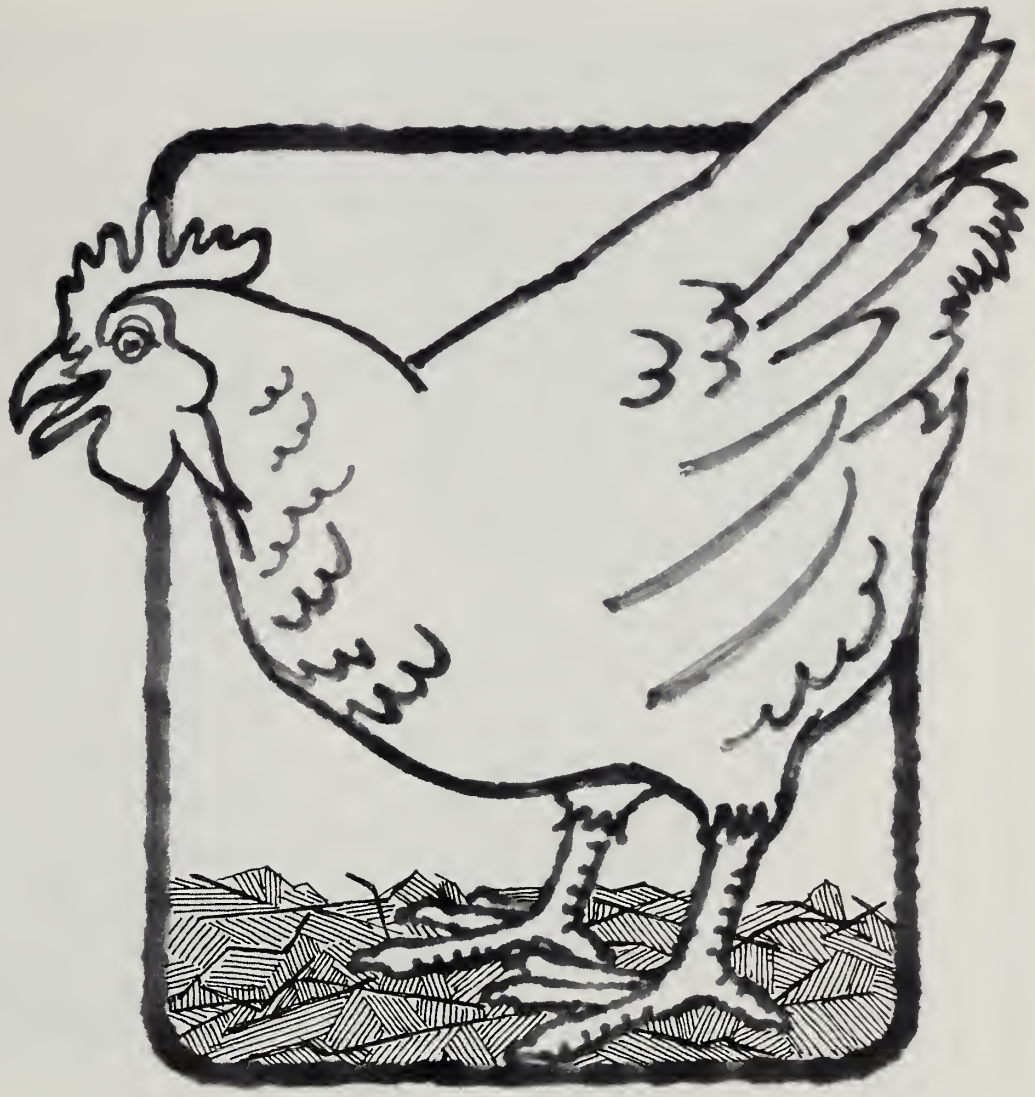
Samples of body fat taken from the tailheads of cows indicated that the encapsulated oil feed also increased unsaturated fat in the muscle. Thus, it may be possible to produce meat as well as milk with increased levels of polyunsaturated fats. □



Research animal scientist H. Keith Georing weighs encapsulated safflower oil and casein particles before mixing them with grain (1271A1599–2).



In growth rate studies, laboratory aide Brenda Murray filters blood plasma extracted from calves fed milk which was taken from cows on unsaturated fat diet. Fat is extracted from the plasma and then analyzed to determine the relative amounts of saturated and unsaturated fat (1271A1600–2).



Long-term protection from

MAREK'S DISEASE VACCINE

THE ARS-DEVELOPED Marek's disease vaccine confers long-term immunity in chickens.

This vaccine was developed from a herpesvirus of turkeys related to the herpesvirus which causes Marek's disease (MD) in chickens (AGR. RES., Jan. 1970, p. 13). The turkey virus is not contagious and does not produce disease in either the turkey or the chicken. In 11 field experiments, however, the turkey virus vaccine protected 80 percent of the chickens from MD for 18 months.

MD is extremely contagious, producing a high rate of mortality in a short time. In the past this disease has cost poultry producers about $200 million annually in losses.

ARS scientists, led by veterinary medical officer H. Graham Purchase and including microbiologist William Okazaki, veterinarian Richard L. Witter, and veterinarian Ben R. Burmester, all of East Lansing, Mich., conducted the studies on over 100,000 female chicks from eight commercial breeders, including one broiler producer. The chicks were vaccinated at 1 day of age, except in one experiment where they were vaccinated when 18 days old. At 19 to 21 weeks of age they were transferred to one of 17 different poultry farms and raised conventionally.

Birds dying during the experiment were autopsied, and the cause of death determined. All surviving birds were slaughtered and inspected at the close of the experiment.

Mortality from MD declined from 19.2 percent without vaccine to 2.8 percent with vaccine in the experimental flocks. Degree of protection did not differ from chicks receiving low (500), medium (2,000) or high (10,000) units of vaccine.

Vaccination reduced the number of birds from which MD could be isolated and also reduced MD in birds harboring the virus and testing positive.

Vaccinated birds produced 4 to 14 percent more eggs and reached 50-percent egg production 2 to 8 days before the unvaccinated controls.

The only losses previously attributed to MD were deaths of chicks during the growing period. In this study, however, the disease was diagnosed in grown birds, while egg production increased in vaccinated birds. As a result, the scientists now believe that MD is responsible for much larger economic losses than known before.

The incidence of lymphoid leukosis, a disease similar to MD, was not reduced by the MD vaccine. □

CHERRIES

can take machine harvesting

SMALL BRUISES can mean large profit losses to the cherry grower.

Because bruising is a major cause of quality deterioration in machine-harvested tart cherries, it became of great concern when the sweet cherry industry began mechanizing. However, ARS scientists found that one variety of sweet cherries, Schmidt, resists bruising well.

ARS food scientist Robert T. Whittenberger of the Eastern marketing and nutrition research laboratory, Philadelphia, Pa., and ARS engineers Jordan H. Levin and Harold P. Gaston at the Michigan Agricultural Experiment Station, East Lansing, conducted the study.

They tested the effects of bruising—severe, dropped six times from 3 feet, and moderate, dropped three times from 3 feet. Moderate bruising roughly equals that which cherries receive when machine harvested. The bruised cherries were stored and heat processed in sirup, and qualities important to the processor were measured.

While stored dry in field boxes after harvest, bruised cherries lost more weight than unbruised cherries. But despite weight loss, severely bruised Schmidt cherries had relatively high yields of quality fruit after processing, even though they had been held at a temperature of 72° F. for 12 to 15 hours. These same conditions would be extremely harmful to tart cherries or to Windsor or Napoleon varieties of sweet cherries.

Moderate bruising caused no significant change in yield or quality of the processed product. The cherries did deteriorate, however, when they were severely bruised and held for 25 hours at 72° F. At temperatures of 38° F. they could be held for several days without deterioration. Maximum yield was obtained with cherries held at 72° F. for 12 to 15 hours after harvesting.

When processed cherries were inspected independently by three USDA inspectors, downgrading was never the result of bruising under test conditions.

The researchers also found that harvesting Schmidt cherries one week later than usual produced an increase of 11 percent in fruit tonnage. □

'Fingerprint' test identifies FOOD CONTAMINANTS

THE "FINGERPRINTS" of micro-organisms may provide a comparatively quick, new method of identification that could help prevent food contamination.

Although present methods of identifying micro-organisms are generally accurate, they are tedious and too time-consuming. To provide the speed and reliability necessary for identifying problem-causing micro-organisms and eventually to insure noncontaminated food, microbiologist Phillip G. Vincent and plant pathologist Martin M. Kulik, Beltsville, Md., worked with PGLC—pyrolysis gas liquid chromatography. This technique has previously been used to describe characteristics of bacteria, fungi, and nucleotides or nucleosides.

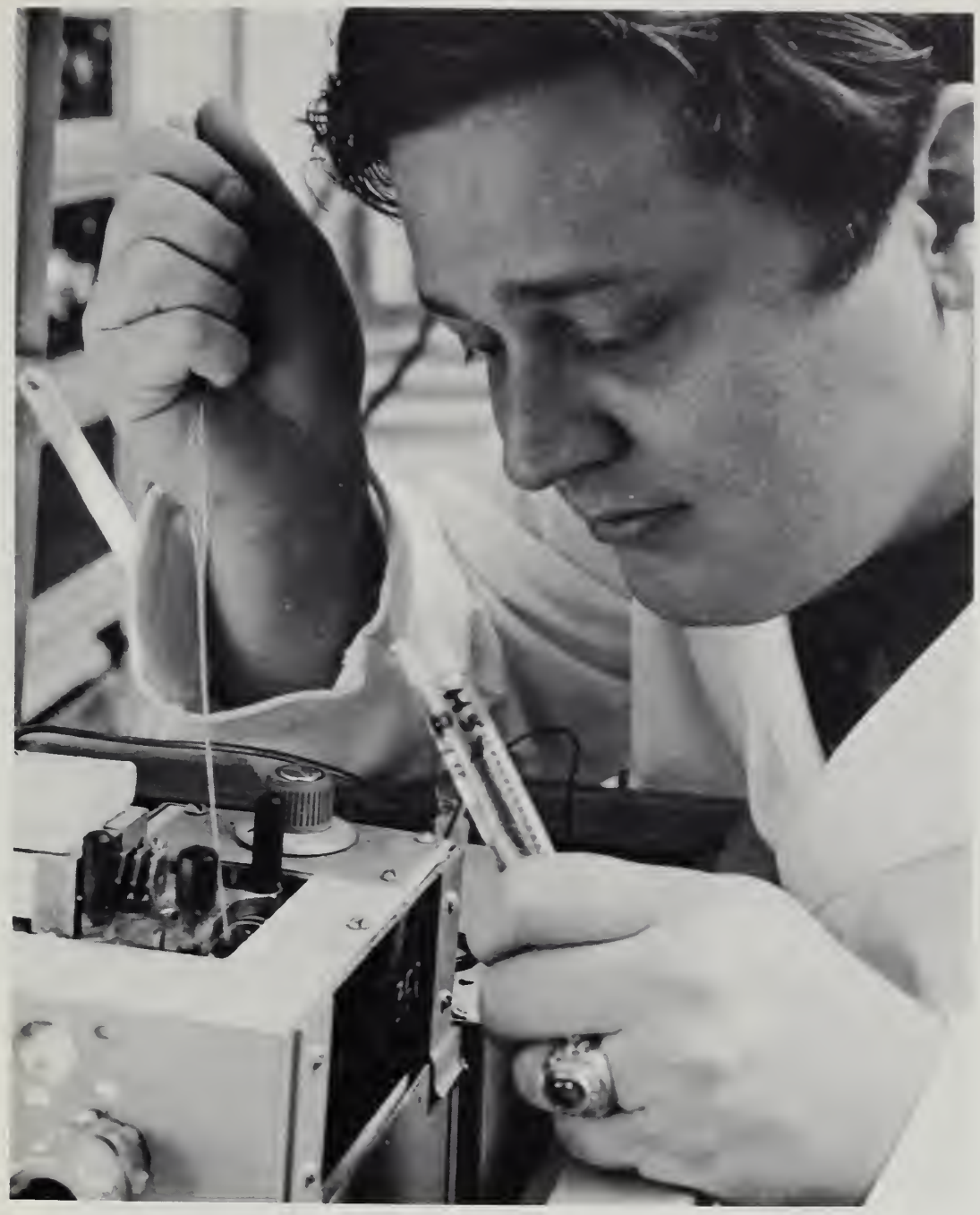
PGLC combines pyrolytic degradation of cells (using heat to chemically break down cell structure) with gas chromatographic analysis to characterize genera, species, and sometimes strains of micro-organisms.

PGLC is based on the principle that organic materials such as micro-organism spores break down into fragments when exposed to high heat. The breakdown for each micro-organism produces a pattern called the pyrolytic elution pattern. This pattern is reproducible, has certain characteristics that are unique to a particular micro-organism, and can be used to identify that micro-organism much as fingerprints can identify a person.

PGLC begins with a micro-organism sample (it can be as little as 2 spores) being placed inside a helium-filled chamber where a nickel ribbon (the pyrolyzer) is connected to an anode (negative pole) and a cathode (positive pole). A current passes through the ribbon, heating the chamber to 900°C.

The high heat degrades or breaks down the spores into fragments that pass through a gas chromatograph column where the fragments are separated. The fragments then pass to a detector where they produce charged particles. The charged particles strike an electrometer, producing a current that activates a pen which in turn records the pyrolytic elution patterns. Resulting patterns can be compared to known patterns to identify a micro-organism.

Using PGLC, Dr. Vincent and Dr. Kulik have been able to characterize species of two mold groups—*Aspergillus flavus* and *Aspergillus glaucus*, *Salmonella* bacteria, and *Helminthosporium maydis*, the fungus that causes corn blight. The next step is to program a computer for pattern recognition to allow for rapid analysis of the PGLC results. □



Dr. Vincent places micro-organism sample on a nickel ribbon in the helium-filled chamber (1271X1507–8).

Above: Comparing the consistency and texture of high- and low-grade sorghum sugars, Mr. Smith sifts the high-grade product through his fingers as chief chemist Bruce J. Lime looks on (871X1056–18).

***Right:** Chemist Robert Romo examines sample of low-grade sorghum molasses taken from sugar pan, or evaporator. Most of the sugar has been removed but to force out the rest, water is evaporated from the molasses, thus depositing the sugar which is centrifuged out (871X1056–8).*

Sorghum

SWEET SORGHUM may one day join sugar beets and sugarcane as a major source of crystalline sugar, opening up new areas to sugar production.

Sweet sorghum is an easily managed crop requiring little labor or water. It yields about 20 tons of stalk per acre and raw sugar estimates range from 180 to 230 pounds per ton of stalk. Although sweet sorghum has been recognized as a potential source of sugar for almost 100 years, lack of good varieties and a practical technology for recovering the sugar have prevented its utilization. New varieties still under evaluation look extremely promising, however, and ARS scientists are now clearing the second hurdle.

Neither of the two sugar production methods in common use today—one for cane sugar, the other for beet—will

*Left: Harvesters cut sorghum cane for pilot plant studies. This sorghum is one of several experimental varieties higher in sugar content and purity than other varieties (871X1055–14). **Right:** Sorghum is crushed in a sample mill originally manufactured for a commercial sugar plant (871X1055–28).*

or sugar

effectively remove the large quantities of starch usually found in sweet sorghum juices.

Starch has always made sugar recovery from sorghum juices either uneconomic or impossible. Conventional processes to recover sugar from vegetable sources require temperatures near 200° F. At these temperatures the starch granules gelatinize and thicken the sirup enough to reduce or even completely prevent sugar crystallization. Although starch content differs among varieties, it increases with the sugar content.

Now, chemist B. Ashby Smith, working at ARS' Food Crops Utilization Research Laboratory, Weslaco, Texas, has found a way to remove the starch by modifying the procedures used for sugarcane juice.

The procedure requires eight steps: 1) stalk preparation, 2) extraction of raw sugar-bearing juice, 3) clarification and removal of starch from juice, 4) evaporation of clarified juice to semi-sirup, 5) removal of additional starch from semi-sirup, 6) concentration of semi-sirup to heavy sirup, 7) removal of the impurity, aconitic acid, from heavy sirup, and 8) crystallization of raw sugar from heavy sirup by conventional sugar procedures.

More than 95 percent of the starch is eliminated in step 3 while the sugar content of the juice is still less than about 16 percent. In this step, using milk of lime or mixtures of calcium and magnesium hydroxides, Mr. Smith adjusts pH to 7.7 to 7.9 to produce a finely divided floc.

Following this, the addition of 3 to 5 parts per million of any of several commercial flocculating agents, described as "high molecular weight polymers of the anionic type" clump the finely divided floc into larger clumps which readily trap the starch granules and settle out. Although some of the juices appear to clarify without adding the commercial flocculating agent, efficient starch removal cannot be achieved.

Juices containing as much as 3-percent starch have been processed successfully to clarified semi-sirups of less than 0.04 percent starch. This level has little noticeable effect on sugar recovery.

Mr. Smith is quick to point out that much research is still necessary to develop the process for commercial use. Also, the present experimental system uses sugarcane processing plants, and future work will include the possible development of a procedure to fit sugar beet facilities. □

Damage done, bollworm emerges from cotton boll (771K929–14).

Stocking the arsenal against

COTTON PESTS

THREE SERIOUS PESTS of cotton are the targets in studies of biological control methods which, if found effective, might someday bolster insecticide use in integrated control programs. These methods might also provide control alternatives for cotton pests that have shown increasing resistance to parathion and chlorinated hydrocarbon insecticides.

THE BOLL WEEVIL: Chilo irridescent virus killed 64 percent of the boll weevils in laboratory tests. Both larvae and adults were affected. Virus obtained from infected boll weevils was, in turn, used to infect other boll weevils as well as larvae of the greater wax moth, which is routinely employed to grow the virus. Tests also indicated that the virus is stable and will not undergo undesirable mutations. If the results can be duplicated or improved in field tests, the virus may make a significant contribution toward control. Entomologists Roy E. McLaughlin and Mario R. Bell, both of ARS, conducted the studies with virologist Howard A. Scott of the Arkansas Agricultural Experiment Station, Fayetteville.

THE BOLLWORM: A tiny parasitic wasp offers promise toward control of the bollworm, also known as corn earworm and tomato fruitworm. ARS chemists Morton Beroza and Barbara A. Bierl, Beltsville, Md., identified and synthesized a compound that attracts the wasp, *Microplitis croceipes*. The compound could be used to lure and retain the wasps in fields requiring protection from bollworms. Identified as 13-methylhentriacontane, the compound was extracted and isolated from the feces of bollworm larvae by entomologists Richard L. Jones, W. Joe Lewis, and Malcolm C. Bowman, Tifton, Ga.

TOBACCO BUDWORM: This insect, which destroyed an estimated 25 percent of the cotton crop in the Lower Rio Grande Valley in 1970, was the subject of field tests at Brownsville, Tex. ARS entomologist Rex L. McGarr employed an isolate of *Bacillus thuringiensis*, a bacterium which produces disease in several cotton pests. The material, an endotoxin designated as HD–1, was particularly effective against the tobacco budworm and bollworm. The Texas Agricultural Experiment Station, College Station, cooperated in the tests.

IN OTHER WORK at Brownsville, studies have been made with insect parasites on some cotton pests. The ichneumonid wasp, *Campoletis perdistinctus*, was known to parasitize at least 27 destructive species of moths and butterflies (AGR. RES., Oct. 1968, p. 11). However, in laboratory and field tests, ARS entomologists Peter D. Lingren and Lloyd W. Noble found the wasps preferred to deposit their eggs in bollworms and tobacco budworms. Accordingly, these insects should be the major targets for the parasite if used in an inundative release program against cotton pests. If the wasps had indiscriminately laid eggs in a variety of host insects, the effectiveness of the released wasps against two of the most important pest species might have been poor. □

Parasites and pesticides don't mix

DEVELOPING PARASITES that are resistant to insecticides offers the prospect of chemical and biological pest

In theory, the chemicals would bring heavy infestations to a level that mass-reared, insecticide-resistant parasites could mop up. As the record clearly shows, natural parasite populations cannot do this job, exposed as they are to the double hazard of insecticides and reduced food supply.

In the past, researchers have attempted to breed insecticide-resistant strains of parasites, but success has been negative or minimal and subject to question. Polish scientists, working under an ARS Public Law 480 grant, obtained conclusive evidence that the conventional single line selection method to develop resistance is unworkable, according to ARS entomologist Reece I. Sailer, Beltsville, Md. Single line selection involves inbreeding from a single line as compared to outcrossing between two or more simultaneously reared generations.

The Poles selected *Trichogramma* wasps for the experiments because of their short generation cycle and importance as parasites in controlling many different insect pests. In the research, single line selection through 70 generations failed to establish a genetically stable, resistant strain of *Trichogramma*. The highest resistance that the scientists could obtain was 22 times that of the control in the 34th generation. After 62 generations, it retrograded to 7.5 controls that are mutually compatible.

Dr. Sailer indicates that research of the future involving systematic outcrossing of 8 to 10 lines, each subject to the same selection pressure, could minimize the deleterious effects of inbreeding and could fix a desired characteristic in a population. Such a complex undertaking, he says, could have positive results extending to many different insects where certain characteristics are desired. Sterile screwworm flies, for example, might be given high superiority in competing with wild males.

Although the Polish results could be regarded as negative, much information was obtained that is useful in explaining field phenomena relating to the action of insecticides and interactions between insect hosts and their parasites.

For example, the Polish scientists determined that *Trichogramma* reared under variable temperatures ranging from 64° to 77° F. are no less or no more resistant to insecticides than those reared at constant temperatures within this range. They also found that *Trichogramma* larvae developing within host eggs are 100 times more resistant to insecticides than are adult *Trichogramma*. However, the adult parasites reared from insecticide-exposed host eggs have reduced longevity and fecundity.

The Polish work was conducted at the Institute of Ecology of the Polish Academy of Sciences, Warsaw, under the direction of Dr. J. Kot. □

Above: *Mr. Shear displays halved apples showing symptoms of cork spot (871K1106–26).* ***Right:*** *Technician Dick Schildt makes scheduled round to feed and and water York Imperial apple trees growing in controlled nutrient cultures (871K1107–8).*

CALCIUM: remedy for cork spot

Cork spot—characterized by hard bitter spots in the flesh of apples—is one of many disorders that can be reduced by a high level of calcium in the fruit.

Cork spot has become more prevalent in eastern apple orchards over the past few years partly because of the replacement of calcium-carrying spray materials with organic pesticides and the failure to supply additional calcium by other means. A high incidence of cork spot renders the apples useless for processing. Spots must be cut out by hand at considerable cost to the processor. In the fresh fruit market, affected apples are rejected.

At Beltsville, Md., plant physiologist Cornelius B. Shear grew York Imperial apple trees on MM26 rootstock in controlled nutrient cultures at varying levels of calcium supply. Leaf and apple tissue samples were taken from the 4-year-old trees and were analyzed for calcium content after cork spot was evaluated on all fruit from each tree.

Mr. Shear found that cork spot was high in apples that had a low calcium level in the leaves or in the fruit. Cork spot was 10 percent or less only when fruit calcium was above 200 parts per million (ppm) in the dry flesh.

Apples require more calcium than the total of all the other major nutrients. Calcium moves slowly throughout the trees and much of it is tied up in insoluble forms. Rootstocks differ in their ability to take up calcium from the soil,

and other nutrients must be kept in balance with the calcium.

Mr. Shear's suggestions for an adequate calcium level in apples are:

- Incorporate lime when preparing soil to bring it up to pH 6.5 for continuous availability of calcium to roots.
- Select rootstocks that readily absorb calcium.
- Avoid overfertilization with nitrogen, potassium, and magnesium.
- Avoid use of ammonia fertilizers before or soon after bloom.
- Avoid overpruning and overthinning of trees.
- Irrigate judiciously.
- Maintain an adequate boron level in trees.
- Apply calcium sprays directly to fruit during the 3 or 4 weeks following full bloom.

Calcium levels in the apple flesh on a dry weight basis should be above 250 ppm to assure freedom from disorders.

The increased calcium will also extend storage life, enhance red color, and reduce the incidence of many apple disorders, such as bitter pit and water core.

Mr. Shear believes that more emphasis should be placed on calcium nutrition—not only in apples but in other fruits and vegetables as well—because research indicates that the severity of many physiological disorders can be reduced by adequate calcium.

Because so many factors must be kept in proper balance to maintain high levels of calcium, Mr. Shear believes that fruit disorders cannot be completely eliminated yet. They can, however, be greatly reduced and the quality and storage life improved with our present knowledge. □

Curbing navel orangeworms

ALMOND GROWERS can control overwintering navel orangeworms by employing natural and cultural means to destroy nuts on the ground in the orchards.

ARS entomologists Charles E. Curtis and Richard L. Coviello, Fresno, Calif., found that maintaining a wet green cover crop or disking under the past season's nuts at normal cultivation time will destroy all or most of the overwintering larvae or pupae.

Estimated navel orangeworm damage to almond crops at harvest ranges from $1.5 to $2 million dollars each year. Further loss occurs when at least half of the infested nut meats are lost or removed during hulling.

Orchard sanitation—removal and destruction of residual nuts from trees, hullers, and other places—has been employed by some growers to reduce the overwintering worm's survival chances, but many growers reject this procedure because they feel it is too costly.

In the spring of 1970 the scientists studied the worm's survival rate on and beneath the ground's surface. Measurements included nut condition, insect mortality in the ground nuts, and the date the first adults emerged and laid eggs in the spring.

The researchers tested three conditions: nuts buried at various depths or disked under the ground surface; nuts remaining on the surface in a heavy, wet cover crop; and nuts left on the surface with sparse or no cover crop.

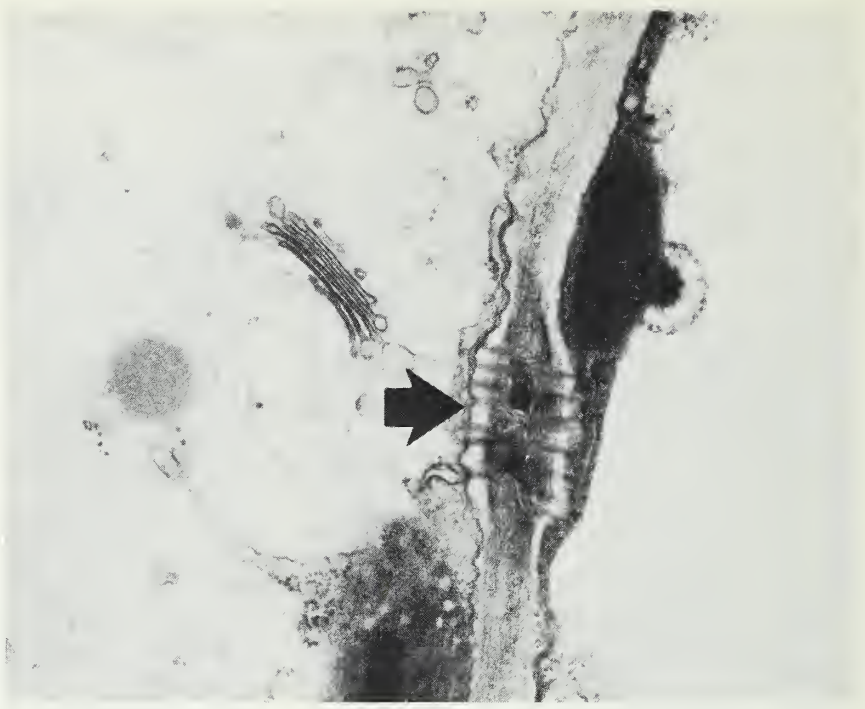
No orangeworm moths emerged from any of the buried nuts in either laboratory or field tests. Lab-tested almonds contained no live orangeworms and were badly decomposed. Field-tested almonds—both disked under and buried—revealed only one live larva despite a lack of ground cover and little irrigation.

Nuts kept on the surface under a heavy wet ground cover in field tests became very soupy. An average of 0.13 live worms per nut were counted, but only one adult female emerged. This was from a more sparsely covered plot that also produced 21 of the 26 live worms found.

In nuts left uncovered on the surface, decay was slow, and larvae and pupae frequently developed. Infestation rates for different almond varieties ranged from 1.8 larvae per nut in the Nonpariel variety to 2.4 larvae per nut for the Jordanolos.

Results indicate that if growers remove residual nuts from the tree limbs and crotches, normal orchard cultural practices will destroy most of the fallen nuts and most of the orangeworm population, providing good control without pesticides. □

Arrow points to plasmodesmata in pit fields traversing the common wall between guard (left) and epidermal cells of horsebean (PN–2006).



FOUND... Guard cell's missing link

EVEN GUARD CELLS have to get "the word."

They may get the word through plasmodesmata, which have been found between epidermal cells and stomatal guard cells on horsebean and tobacco leaves.

Plasmodesmata are intercellular bridges or protoplasmic lines of communication between cells, carrying stimuli and offering plausible routes for the translocation of materials such as sugars and hormones into and out of cells. Stomata are tiny pores—a single corn leaf may have as many as 1 million—in plant leaves through which the plant "breathes." In most plants stomata are formed by two dumbbell- or kidney-shaped guard cells capable of separating from each other to form the pore. Epidermal cells form the outside layer of the leaf.

Biologists have known for some time that cells are connected by plasmodesmata but thought guard cells were an exception.

ARS plant physiologist James E. Pallas, Jr., Watkinsville, Ga., in cooperation with the Georgia Agricultural Experiment Stations, and Hilton H. Mollenhauer of the Kettering Institute, Yellow Springs, Ohio, recently photographed the plasmodesmata occuring between guard and epidermal cells with the aid of an electron microscope.

The plasmodesmata were found in pit fields—small depressions—of transverse walls and showed considerable complexity in branching. The findings may have an important bearing on interrelations between guard and epidermal cells.

Understanding guard cells is important to both man and plant life, because through such cells, atmospheric carbon dioxide must pass on its way to photosynthesis. In turn, oxygen produced in photosynthesis must find its way back to the atmosphere to satisfy man's need for respiration. Also, as a consequence of such gaseous exchange, large quantities of water are lost, some of it possibly unnecessarily (AGR. RES., Aug. 1968, p. 12). □

Once-over for mums

A FLORAL PRESERVATIVE permits once-over harvesting of chrysanthemums.

In a typical commercial operation, mums are repeatedly harvested as they open, consuming time, labor, and money.

ARS horticulturist Francis J. Marousky, Bradenton, Fla., studied the feasibility of harvesting all the flowers at one time as buds. For his tests, he randomly selected plots of Albatross chrysanthemum flowers about a week before the commercial stage.

Harvesting half the flowers from each plot as buds, Dr. Marousky placed the stems in 200 parts per million 8-hydroxyquinoline citrate plus 2-percent sucrose and held them in a bulb curing room at 72° to 76° F. The remaining buds were allowed to open on plants in the field. Bud-cut flowers were similar in size and quality to flowers opened on the plant.

Harvesting mums as buds offers the grower flexibility in his marketing program through quality maintenance, ease of storage, and disease control.

The preservative is commercially available. □

AGRISEARCH NOTES

Luring beneficial insects to crops

Wild beneficial insects some day may be "recruited" to stand guard over cultivated crops.

At College Station, Texas, ARS entomologists Richard E. Kinzer and Richard L. Ridgway are spraying cotton foliage with artificial diets containing a protein supplement plus sugar. They hope to lure predatory insects from fence rows, untilled fields, and cultivated crops into cotton to help provide effective levels of biological control.

Mr. Kinzer and Dr. Ridgway originally used the high-protein artificial diet to maintain laboratory colonies of the green lacewing whose larvae—called aphid lions—prey on several species of insect pests. Aphid lions are harmless to crops, animals, and man and have a negligible effect on other desirable insects. The diet is easily biodegradable and poses no problem of environmental contamination.

Dr. Ridgway refers to the artificial diet as a potential habitat management tool. It may help solve a problem that occurs when crops such as corn and cotton are grown in the same area. Corn, which generally has relatively large populations of lacewings, begins to mature about the same time that highest levels of biological control are needed in cotton. Spraying the artificial diet on cotton during this period may lure lacewings out of the cornfield where their services are no longer needed and into the cotton.

The beneficial effects of the aphid lions may be buttressed by other insect predators, such as lady beetles and pirate bugs, which are also lured into cotton by the artificial diet.

Shipping gladiolus 'good as new'

Gladiolus placed in a floral preservative after shipping develop more open florets and live almost twice as long as gladiolus held in water.

Present marketing practice dictates harvesting spikes with unopened buds, grading the spikes, then wrapping them in kraft paper and transporting them at 40° F.

Seeking improvement on this method, ARS horticulturist Francis J. Marousky, Bradenton, Fla., packed White Friendship gladiolus in vented and nonvented containers that were subjected to simulated shipping conditions for 3 days at 40° and 50° F. Kraft paper or polyethylene plastic sheeting covered the spikes during shipment. Afterwards, spikes were held at either 74° F. in water or in 400 parts per million of the preservative 8-hydroxyquinoline citrate plus 3-percent sucrose (8−HQC+S).

Spikes held in 8−HQC+S continued to produce open florets and remain turgid for 8.5 to 10 days. Spikes held in water wilt after 4.5 to 6 days. Polyethylene wrappers prevented moisture loss, while kraft paper permitted 9- to 10-percent loss, but this loss did not affect floret opening. Floret quality was not affected by type of carton—vented or nonvented.

Floret quality of spikes held in 8−HQC+S remained the same whether shipped or not and was superior to those spikes not shipped and held in water.

Test results indicate that gladiolus spikes harvested in the bud stage and handled and shipped at low temperatures—40° to 50° F.—potentially can produce as many open florets as freshly harvested spikes. Additional enhancement of floret opening can be achieved after shipping if spikes are held in 8−HQC+S.

The preservative, 8-hydroxyquinoline citrate plus sucrose, is available commercially.

Sex-altered rams grow best

Sex-altered rams have higher weaning and slaughter weights than wethers.

Castrating male lambs is a common practice among sheepmen because of market discrimination against uncastrated rams raised for slaughter—even though rams tend to weigh more at slaughter and have less excess fat than wethers.

Sex-altering, however, can eliminate the discrimination against slaughter rams while producing growth rates

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similar to those of rams. Sex-altered, also called induced cryptorchid or short-scrotum, rams are animals in which the tests have been elevated into the body and the scrotum removed by elastrator.

The effects of sex alteration and creep feeding on different breeds of sheep were evaluated by ARS sheep nutritionist Hudson A. Glimp at the U.S. Meat Animal Research Center, Clay Center, Nebr. The experiment involved 873 lambs representing seven breed lines: Suffolk, Targhee, fine wool, coarse wool, grade (7/8) Targhee, Corriedale, and Navajo.

Dr. Glimp randomly assigned lambs to treatment groups. He placed the females on pasture and assigned the males to either of two feeding treatments—creep fed with a free-choice ration or no creep feeding. Four sex treatments were represented within each feeding group: Unaltered rams, unaltered rams receiving 3 mg of diethylstilbesterol, wethers castrated at birth, and sex-altered males.

Wethers had the lowest weaning weights and were the lightest per day of age at weaning of all the males. They were also the lightest of the males at slaughter. Ewes were the lightest overall.

Highest carcass grades and dressing percentages, however, belonged to the wethers and sex-altered males. The diethylstilbesterol-implanted males had the same growth rates and carcass traits as the untreated rams.

Growth and carcass traits of the lambs were not affected by creep feeding since little creep feed was actually consumed.

Among the breed groups, Suffolk lambs gained the fastest and Navajo lambs the slowest of all lambs. Carcass grades showed the same trends, with Suffolk rating highest and Navajo lowest. The Corriedale and grade Targhees had higher carcass grades than the purebred Targhee lambs. The highest dressing percentage was from the coarse wool sheep.

Sugar fatal to house fly larvae

Sugar attracts house flies but it will kill house fly larvae when placed in manure where the flies breed.

ARS dairy scientist, Richard W. Miller tested three sugars (dextrose, lactose, and sucrose), corn starch, and ethyl alcohol to determine the larvicidal properties of each. The compounds were mixed with manure at levels ranging from 0 to 10 percent. The manure was then seeded with day-old house fly larvae, and 8 days later the fly pupae were counted.

With 8-percent dextrose or 10-percent lactose or sucrose, mortality of the house fly larvae was 94 percent or higher. Corn starch caused no mortality, but ethyl alcohol killed all larvae with levels as low as 5 percent.

Ethyl alcohol was tested because sugar ferments to alcohol in the presence of certain enzymes. Dr. Miller believes that this fermentation may be the larvicidal mechanism, but further investigations are underway.

Though sugar has been shown to be an effective larvicide, its practicality is limited by the need for large amounts. Dr. Miller hopes that by establishing the larvicidal mechanism, a cheaper product may be possible.

U.S. GOVERNMENT PRINTING OFFICE:1972 O—455-025